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ABSTRACT

The Teaching Excellence for Minority Student Achievement (TEAM) Program is a 5-year supplemental program in the Los Angeles (California) area designed to demonstrate that urban minority low income students at risk of school failure can be refocused using an interdisciplinary approach to teaching elementary and middle school science and mathematics as well as building self-esteem and developing critical thinking, observational, and communication skills. The TEAM Program provides support for math and science teachers, principals, and students. In one portion of the program, the Summer Institute for Teachers, teams of teachers developed units of study using an interdisciplinary approach to teaching science. Teachers participating in the program reported that the growth of collegiality was highly motivating and reduced feelings of stress and isolation among teachers. After participating in the overall TEAM program, students raised their scores on standardized tests 10 to 20 percentile points. The substantial costs of the TEAM Program as well as the significant outlay of time and effort required were seen as barriers to replicating the program. An outline of the TEAM general plan is attached as are ratings by teachers and principals of TEAM program activities and effects, and a chart summarizing TEAM activities and participant numbers. (ND)

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THE TEAM PROGRAM: TEACHING TEACHERS TO UTILIZE AN INTERDISCIPLINARY APPROACH TO SCIENCE FOR URBAN STUDENTS

T. Jean Adenika-Morrow

INTRODUCTION

A coalition of teachers and principals dedicated to reforming education, in partnership with an urban state supported university located in the Los Angeles Basin, executed a five year supplemental program for math and science teachers, school administrators and pre-adolescent minority students. This five-year program, Teaching Excellence for Minority Student Achievement Program (TEAM Program) conducted a 16-month intensive course and follow-up for math and science teachers from schools serving low-income, urban areas. This report discusses the portion of the TEAM Program that was successfully executed from August 1992 through December 1993. Specifically, this report will focus on the Summer Institute for teachers, the training they received and the method in which they developed interdisciplinary science curricula. To a lesser extent, the principals' training portion of the Program will also be discussed.

The Eisenhower Mathematics and Science Education Program (Eisenhower Program) provided the funding for the TEAM Program. The Eisenhower Program represents a federal initiative supporting professional development of the nation's mathematics and science teachers (U. S. Department of Education. (1991) . *The Eisenhower Mathematics and Science Education Program: An Enabling Resource for Reform, Summary Report*. Washington, DC). The purpose of the Eisenhower Program is to support current efforts to reform teaching in mathematics and science. The Eisenhower Program involves approximately $200 million which is made available in the form of state and local grants to pay for costs associated with professional development activities. More than 90 percent of all school districts and approximately 20 percent of all degree-granting postsecondary institutions in the nation receive Eisenhower Program funds, either directly or indirectly (U. S. Department of Education, 1991).

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The primary purpose of this facet of the TEAM Program was to provide support for math and science teachers including support for lead teachers. This aspect of the TEAM Program, the Summer Institute, was primarily directed at assisting teachers, including lead teachers, to make the fundamental changes in their pedagogical strategies in order to assist minority students achieve success in math and science. The query remains as to whether the participating lead teachers would serve as models at their school sites for other educators at their school sites who wish to increase their success with teaching math and science to minority students.

In addition to providing support for lead teachers, the program was designed to serve as a vehicle to form a coalition between teachers to develop professional comradery with each other. The result being 1) assembly of high quality science curricula, 2) assembly of appropriate assessment tools, and 3) curricula and assessment tools tailored to the needs of minority students. In addition, the TEAM Program served to provide support for participating school principals with the purpose of determining the types of support needed by principals as leaders and as facilitators of reform at their school sites.

STRUCTURE OF THE SUMMER INSTITUTE FOR TEACHERS

The structure of the Summer Institute involved three types of teams of educators. The elementary team were composed of five teachers who were identified as most interested in science at their school site. Each team had four grade level representatives and one language development specialist. All were provided with the books, *It's Elementary, Interdisciplinary Curriculum Design and Implementation* and *The California Science Framework,* which are both published by the California Department of Education. The teachers were also issued published articles dealing with access and equity issues. There were two middle school teams. One middle school team was interdisciplinary and was composed of one teacher for each of the four subject matter disciplines and one language specialist. The other

middle school team was intra-disciplinary and had eight science teachers and one lead teacher in language development and technology. Each team was assigned the task of developing units of study using an interdisciplinary approach to teaching science. The resulting science curriculum was to be used at the school sites. Much of the work on the curricula was accomplished by the Science Curriculum and Instruction Improvement Team.

The TEAM Program was founded on the premise that building a school site leadership team, supported by the site principal, two lead teachers and three additional supporting teachers who were developing leadership skills, would facilitate school-wide implementation of this interdisciplinary approach of teaching low-income minority children. In furtherance of that goal, the TEAM Program consisted of several instructional and team building activities. The following is a list of activities conducted by the administrators of the TEAM Program held from 1992 to 1993:

Summer Institute for Teachers
Principal to Principal Institute
Spring Planning Retreat
Lead Teacher Meetings (7) and Leadership Training Sessions (3)
Principals' Planning Meetings (2)
School-site Consultation between Principal and Project Associate
Pre-service Student Teacher Support
Saturday Family Math and Family Science Field Days
Parent Workshops Provided by Project Associates
Interdisciplinary Thematic Science Curriculum and Instruction Team
Participation in CA Science Project
Participation in the Math Academy

RESULTS OF THE TEAM PROGRAM

The beneficial outcomes most common among the Eisenhower program projects throughout the country were also evident in the results of the TEAM Program:

a) Awareness of developments in the professional community. Teachers were made aware of the current developments in math and science pedagogy.

b) Contact with peers and other professional staff. Teachers developed a network of professionals with which to communicate and share information.

c) Awareness of the impact of cross-cultural teaching and learning issues. Teachers were led to reconsider their expectations of the learning capabilities of ethnic minorities in relationship to math and science.

d) Rededication to the profession of teaching. Many of the participating educators indicated in their journals and in TEAM Program surveys, that they felt a sense of renewal in their chosen profession.

e) Teachers' earnest efforts to expand their pedagogical skills in their teaching of math and science. Many expressed eagerness to increase their skills/competency in order to garner recognition as lead teachers at their school sites.

f) A significant number of teachers, especially elementary teachers, were dedicated to improving math and science education throughout the school district and were willing to put forth the necessary effort to network with other teachers and administrators in order to facilitate appropriate changes

ACCOMPLISHMENTS AS VIEWED BY PARTICIPATING TEACHERS, PRINCIPALS AND TEAM PROGRAM COORDINATORS

The participating educators articulated their satisfaction in their evaluations of the TEAM Program that their assessments of the Program were taken seriously as an integral component of the creation of a viable program for eliciting student achievement. Second, teachers highly rated one of the end results of the Program as the development of quality thematic science units that could be used successfully with students. Third, teachers expressed that the growth of collegiality and working together with other educators was highly motivating. This group support functioned exceptionally well to hold the educator component of the program intact even during the severe financial and morale crisis that occurred within the school districts that were represented by the educators.

When responding to the TEAM Program survey, participating principals expressed that the Principals' Institute and the school site consultation between each principal and the corresponding project associate were the most helpful components of the Program. During the school term, there was great tension between the school district, the teachers and the teachers' union. However, the attendance and participation of the project associates continued nevertheless. Several principals were confident of the high level of participation at their school sites. It should be noted however, that involvement of the principal at the school site was the key component of the implementation of the TEAM Program at the school sites.

The TEAM Program Coordinators expressed a number of important accomplishments. First, the TEAM Program provided a effective forum for productive working sessions among educators. Part of the working sessions included two uninterrupted days to "brainstorm" and to develop the initial phases of the Thematic Science Units of Study, which proved to be quite productive. Both middle school teams assembled Thematic Science Units of Study that were successfully tested with their students. The elementary school teams also assembled

Thematic Science Units, but were also provided staff development for their faculty. The process was difficult for elementary school teachers, due to their lack of training in science. In the past, science workshops for elementary school teachers provided only superficial instructions for teachers. The process of creating and developing Thematic Science Units, provided training for elementary school teachers in both science concepts and in clear methods of presenting the science curriculum to students.

The second major accomplishment of the TEAM Program was the educators' increased knowledge of science. Third, educators and principals assembled together to evaluate past pedagogy and to plan future science offerings at their school sites. Fourth, principals who participated in the Program were confident that they would follow through with the curriculum and methodology resulting from the program.

Documentation of student improvement was the most important accomplishment of the TEAM Program. Students improved their accumulation of knowledge in math and science and were eager to continue learning about math and science. Documentation of student improvement occurred during the TEAM Program and at the school sites. Prior to their involvement in the TEAM Program the students tested in the first to the fifth percentiles. After participating in the Program the students raised their scores ten to twenty points. Even though these scores are extremely low, the raising of the test scores showed the effectiveness of the program. The teachers at the school sites who were involved in the TEAM Program expressed enthusiasm for the program due to the raising of the test scores. Participating principals reported that as a result of the new curricula and improved school culture, there were large numbers of faculty members who became involved in the Program at the school sites.

RESOLVED ISSUES WHICH LED TO ACCOMPLISHMENTS

When the participating educators coalesced into teams, feelings of stress and of isolation were greatly reduced. The teachers could then focus on the tasks ahead, which in turn, allowed them to be productive. In addition, the teachers were led to confront their low expectations of the learning capacities of low-income minority students. Once the teachers admitted of their employment of the "Cultural Deficit Theory," only then were they open to believing that minority children have the abilities to learn science. From that point, the teachers were disposed to develop appropriate interdisciplinary science curricula for use at their school sites.

BARRIERS TO REPRODUCTION OF THE TEAM PROGRAM

The first major barrier to consistent teacher participation was the severe financial distress of the school districts from which the teachers derived. Once the crisis was over, full participation rates resumed. It should be noted that even in the midst of the financial crisis, most teachers continued to participate in the TEAM Program.

Second, the substantial financial cost of the TEAM program may cause duplication of the entire program to be prohibitive in many school districts. However, some segments of the TEAM Program may be duplicated where there is avid volunteerism, non-monetary compensation to faculty and in-kind contribution of materials.

Third, the execution of the TEAM Program required a significant outlay of time and effort. For example, one major issue involved the lack of adequate time and financial support to complete the Interdisciplinary Science Units of Study. However, teams from five schools were well on their way to completion of Interdisciplinary Science Units of Study to be used at the school sites. However, this barrier could be surmounted by using the suggestions listed in the previous paragraph.

A fourth major issue evolved during the year; principals wanted the individual activities of the TEAM Program to be conducted at the school-site. This was an impossibility due to the structure of the Program and the availability of staff time. The principals believed that weekly program contact in both mathematics and science inservice would help their teachers to increase student achievement scores. This issue, strongly expressed by some, was far more prevalent at the elementary level (9 schools) than the secondary level (4 schools). Unfortunately, the level of funding would need to be increased significantly to provide the level of on-going, individual school based instruction and assistance requested by the principals.

CONCLUSION

The TEAM Program provides an example that urban minority low income students who are at risk of school failure can be refocused using an interdisciplinary approach to teaching science. Using science, educators can elucidate the students' belief about him/herself as being capable of learning math and science, and enjoying the learning process. The interdisciplinary approach to teaching science allows the student to accumulate knowledge as well as to develop critical thinking skills, observational skills, and communication skills, which builds self-esteem. In order to pragmatically present science using an interdisciplinary approach, educators must educate themselves in the current subject matter and raise their own expectations of the students they teach. School administrators, as leaders and catalysts for change have vital roles in supporting and facilitating this interdisciplinary approach to science in urban and low income communities throughout the nation.

TABLE 1 TEACHERS' AND PRINCIPALS' RATING OF ACTIVITIES 1992 - 1993

Rate	Activity
3.0	Summer Institute for Teachers
2.92	Principal to Principal Institute
2.9	Spring Planning Retreat
3.0	Teacher Leader Meetings (7) and Leadership Training Sessions (3)
2.61	Principal's Planning Meetings (2)
2.91	School-site Consultation between Principal and Project Associate
2.75	Pre-service Student Teacher Support
2.81	Saturday Family Math and Family Science Field Days
2.6	Parent Workshops Provided by Project Associates
2.92	Interdisciplinary Thematic Science Curriculum and Instruction Team
2.2	Participation in the California Science Project
2.72	Participation in the Math Academy

Scale: 3 = Above Average 2 = Average 1 = Needs Improvement
n = 21 Principals and Lead Teachers

TABLE 2 SURVEY OF PRINCIPALS, LEAD TEACHERS AND SCIENCE TEAM MEMBERS

Rate	Statement
4.14	overall deepening of the teachers' relationship with the academic discipline or change strategy for improvement.
3.9	deeper understanding of discipline's subject matter content
4.42	greater confidence/enthusiasm in teaching the subject matter
4.21	greater skill in the practice of the discipline itself (e.g., science, math)
4.33	greater skill in the use of strategies to improve or reform practices that are beneficial to the school and its students as a whole.
3.5	overall deepening of the teachers' relationship with students.
3.57	increased understanding of students learning capabilities - processes
4.3	increased understanding of students from diverse backgrounds
4.68	overall deepening of the teachers' relationship with other teachers
4.62	enhanced interest/ capability in working collaboratively with other teachers
4.27	increased leadership abilities
4.71	deeper sense of professionalism in teaching
4.0	overall improvement in science or math education
4.0	reforming science curriculum at the elementary - secondary level
3.9	improving teachers' content knowledge base
4.1	improving pedagogical skills
4.0	serving historically under represented students

BARRIERS

2.78	lack of interested teachers
2.71	lack of collaboration with school district
3.0	lack of funds
2.28	lack of clarity about the role of curriculum development
2.0	lack of clear relationships with other science and mathematics reform efforts
2.69	lack of clarity about the role and purpose of alternative assessment methods

Scale: 1 = minor contribution; 5 = major contribution
Total number of respondents = 28

TEAM PROGRAM GENERAL PLAN FOR THEMATIC AND INTERDISCIPLINARY SCIENCE UNITS OF STUDY

The design of this program involves four teams of professionals who will commit to accountability for their portion of improvement of the science curriculum for their school site.

The objective of this curriculum and instruction improvement program is to strengthen science education in grades K-8 through the development and pilot testing of three interdisciplinary science units of study in four elementary and two middle demonstration schools which serve low income African American and Latino children who are "at-risk" of continuous low achievement in science and related academic subjects.

TEAM ORGANIZATION

A. **The Assistance Team** -A major state-supported university in the Los Angeles Basin will provide the professional development, logistic, organization and partial financial support needed by the School-site Leadership Team to fulfill the objective shared by the Program and the individual schools.

B. **The School-site Leadership Team** will direct the school improvement, which includes science curriculum and instruction efforts at their school. There are two lead teachers on each team, one has a mathematics specialty and the other specializes in science.

C. **The Science Curriculum and Instruction Improvement Team** will participate in a staff development institute to assemble the Interdisciplinary Science Units of Study. Working with the School-site Leadership Team, they will plan how the Science Units of Study will be implemented at their school. Since elementary faculty teach all subjects, implementation of an Integrated Model is predicted to be easier than at the secondary level where the traditional Fragmented Curriculum Model has been the norm.

D. **The School-site Implementation Teams** are the groups of volunteer teachers at each school who will implement the Interdisciplinary Science Units of Study and the accompanying instructional mode into their classroom for a pilot test. It is not expected that the full faculty will participate in this initial stage. The participating faculty volunteers are willing to be held accountable for the outcomes of implementation and the subsequent revisions necessary for academic achievement. It is further expected that the school-site teams will be ethnically representative of the ethnic backgrounds represented at the school sites.

TEAM METHOD

It must be stated clearly that this program is not a curriculum development project; it will build Interdisciplinary Science Units of Study from research in science education, curricula developed by other entities, trade books and science materials purchased by the program to augment the old textbooks and existing science materials. All of the material used will be inventoried and synthesized to design Interdisciplinary Science Units of Study to fit the specific needs and science directions of the teachers and students in the participating schools.

The Interdisciplinary Concept Model will be followed in building units of study with Science as the foundation or "organizing center". The concepts inherent in the pedagogical science themes (energy, systems and interactions, and scale and structure, etc.) outlined in the California Science Framework easily adapt themselves to building Science Units of Study which will include the following disciplines: language arts, language development (ESL, Bilingual Ed., sheltered English, and Black Dialect), social studies, mathematics and multicultural education concepts.

The majority of K-7 teachers are not science majors, have science anxiety, and feel that the current curriculum is overwhelming. Considering this posture, the Assistance Team will facilitate the Science Curriculum and Instruction Improvement Team develop Interdisciplinary Science Units of Study that decrease textbook centeredness and are activity-based. A program such as this is designed to awaken academic energy in students which, in turn, will assist with the acquisition of content and methods of learning. At the same time, the Units of Study will include cultural receptiveness to the needs of African Americans, Latinos and low income students.

The program will address the consistent themes of national reports which recommend curriculum and instruction improvements through the following actions: covering fewer topics in greater detail, a weakening of subject area boundaries, and more attention given to the connections between science, language arts, mathematics and social studies. Research has shown that "hands-on" science and math instruction increases creativity, perception, logic and language development. Integration of science with language arts and social studies concepts that complement each other should increase students' mastery of content and skills demanded by national committees. The inclusion of these considerations in the pilot testing will give insight into how this pedagogy is best applied to the student population.

The program's developmental process will increase the scientific knowledge base of the elementary classroom teacher and expand the collegial working styles of secondary teachers. If the plan to enrich instruction in K-12 grade levels via Interdisciplinary Science Units of Study is successful along with the accountability

strategy, and other school reform measures are continued, then gradual but consistent academic achievement in science and mathematics should become more stable for low income minority students. If the implementation phase progresses as planned, it is probable that more minority students from low income backgrounds will be qualified for college preparatory classes in senior high school and therefore enabled to meet college admissions standards.

This facet of the TEAM Program will concentrate on: (a) developing Interdisciplinary Science Units of Study that are culturally inclusive; and (b) guiding administrators and teachers through the implementation process and thus, making them aware of using science as a powerful discipline for the integration of other subjects, reinforcement of critical thinking skills, building problem solving skills, and building self-esteem.

It should be noted that integrated discipline activities and content are appropriate when they promote progress toward significant educational goals and when they foster accomplishment of major goals in each subject areas wherein it is integrated. Therefore, it is not expected that the entire content of mathematics, English, language arts and social studies can be taught in and interdisciplinary manner with science as the "organizing center". The Science Curriculum and Instruction Improvement Team for each school with the Assistance Team's content area experts will make those decisions as the development of the Science Units of Study proceeds.

TEAM PROCESS

A. **Science Curriculum and Instruction Improvement Team Education**

Each member of the Science Curriculum and Instruction Improvement Team will be encouraged to complete a college level course in their discipline at whatever stage they feel will improve their subject matter content knowledge. The Assistance Team will provide information on courses offered by junior colleges and universities in the area, the County Office of Education, and other funded projects.

B. **The Interdisciplinary Science Curriculum Institute**

The Science Curriculum and Instruction Improvement Team working with The Assistance Team will meet one day per week during the Spring at a state supported university in the Los Angeles Basin to develop Interdisciplinary Science Units of Study. The elementary and middle school science teams will be recommended by the School-site Leadership Team to represent each participating school.
The Institute will be divided into three parts: (a) development of Units of Study, (b) content knowledge sessions presented by subject matter experts in the field, and (c) independent work.

Examples of resources for development of Interdisciplinary Science Units of Study include all the State Frameworks, *The Mindful School:How to Integrate the*

Curricula by R. Fogarty, materials/programs from the U.C.-Lawrence Hall of Science; future state adopted materials from such commercial vendors such as Addison Wesley, Scott Foresman, Holt, Rinehart and Winston of HBJ and Prentice Hall. Additional resource material what will be used are: publications of the National Science Teacher Association and The Association for Supervision and Curriculum Development, Northwest EQUALS, AIMS Education Foundation, a variety of science/ mathematics activity publications as UNESCO Science Experiments for Everyone, and multicultural education materials from Banks, Grant, Sleeter, Gollnick, Chinn, Tiedit and others. *The Science Framework, It's Elementary*, and *Caught in the Middle* published by the California Department of Education and *Jacobs' Interdisciplinary Curriculum* by Heidi Jacobs will be given to each participating teacher.

C. **Semester Field Testing and Assessment**
The School-site Leadership Team and The Science Curriculum and Instruction Improvement Team will review and assess the Interdisciplinary Science Units of Study for refinement in consideration of the student profiles for their school. The results will then be presented to the School-site Implementation Team for assessment and further refinement for their particular classrooms. Any necessary inservice will be arranged by the lead teachers with available resources.

The Interdisciplinary Science Units of Study will be pilot tested for one semester with accompanying pre/post assessment of student achievement. At the end of the semester, all participants will attend an all-day workshop session at the university to share and discuss their outcomes in preparation for revisions of the Interdisciplinary Science Units of Study. Experts experienced in interdisciplinary curriculum and instruction will provide input and The Assistance Team will help with analysis, revision and planning for school adoption. Once consistent achievement trends can be associated with particular curriculum and instructional strategies, activities to assure that the strategy remains in the school instructional culture will be put into place in consultation with the School-site Leadership Team.

It is estimated that each elementary school will need to continue professional training in science for its faculty, but the "flexible" science units of study will allow for the individual variance in science expertise. The Assistance Team will help the school science teams develop a "user friendly" teaching manual that links science themes to student learning outcomes.

CHART A. SUMMARY OF ACTIVITIES AND NUMBER OF PARTICIPANTS SERVED

Title	Average # Participants	Type of Offering	Time of Year	Length of Each Activity	Total Length of the Activity	Stipends Paid and/or Fees Charged or Free*
1. Summer Institute	163	residential institute	Summer '92	8 hrs./day	32 hours	included in yearly fee*
2. Spring Planning Retreat	72	residential retreat	Spring '93	1 1/2 day	16 hours	free*
3. Lead Teacher Meeting /Training	12	planning mtgs. & leadership training	calander year	3 hrs., Sat. & evenings	24 hrs.	free
4. Principal Planning Meetings	11	plan activities	Fall & Winter	4 hours	8 hours	free
5. Principal - Project Associate Consultant.	26	technical assistance	Winter & Spring	3 hours	198 hours	free
6. Principal Institute - follow-up	15	training & feedback seminar	Fall, Winter & Spring	8 hours	24 hours	free
7. Parent Workshop	120	test prep to help children	Spring	2 hours/ day	12 hours	free
8. Pre-Service Assistance	21	teaching assistant	Fall, Winter, Spring	10 weeks/ 30 hours	800 hours	free
9. Family Math & Science Field Days	65	series of workshops	Fall & Spring	5 hours/ day	12 hours	free*; transportation provided sch.dist.
10. Math Academy or Ca. Sci. Proj.	15	external projects	Winter Spring	1 to 3 weeks	varied	varied*

* Some of the principals paid their teachers stipends, depending on activity